HAMATEUR CHATTER

The Milwaukee Radio Amateurs Club

July 2009, Volume 17, Issue 7

Presidents Letter

Welcome to my second president's letter, but don't go looking for the first one. It won't be seen for quite some time, if ever.

This president thing is new to me. I took on this duty because I've observed a change in this club. I've heard from members about problems, both real and perceived. I want this column to be a place where you can hear from me and, in turn, feed back your opinions, comments and information to help move this group in a positive and healthy direction. It can be done. Other clubs are active and healthy and there is no reason why this one can't be better. Better than it is now and better than other clubs.

To this end, I started to put some ideas to paper in my first letter. I quickly realized this wasn't good for a couple of reasons. First, we have some more pressing tasks to address (more on this below) and second it might taint input from the group. This leads to my first request. What do you think is good about this club? What needs improvement? Let me know. See me at the membership meetings. Come to a board meeting. Email me at ab9cd@arrl.net. I want to know what the membership wants. I have some ideas, but the group should determine our direction. You'll hear about the feedback I receive in future columns.

Now for some of the pressing tasks mentioned above. First we need to recruit two new officers. My election to president leaves a vacancy for the treasurer position. My election to president leaves a vacancy for the treasurer position. The club's financial records are in good order and transfer of these duties will be easy. This position only requires a couple of hours each month with a bit more during renewal 'season'. Any one with Excel spreadsheet experience is more than qualified to take on this duty.

We also have a vacancy in the secretary position. Sarah resigned from the position back in June. She has promised to organized and catch up the minutes from board and membership meetings and turn over the records in good order. I expect this to happen in the next month. The position doesn't demand a great deal of time but is important to keeping the board on track and keeping the membership informed about club activities and meetings.

We need to get the board staffed and working at full strength before tackling other issues. Getting the board staffed and working to improve the state of the club will take participation from our members. Now is the time to step up and the time voice your suggestions! Getting this done will let us talk "radio" in future columns.

Mark AB9CD

MRAC Officers:

Terms Expiring in 2010

- President – Mark, AB9CD
- V-President-Brian, K9LCQ
- Secretary – Vacant
- Treasurer – Vacant
- Director – Dave,WB9BWP
- Director – Dave,KA9WXN

Terms Expiring in 2011

- Director – Al, KC9IJJ
- Director – Howard, AB9FH
- Director – Mike, KC9CMT

The Club Phone Number is: (414) 332-MRAC or

(414) 332- 6 7 2 2

Visit our website at:

www.w9rh.org

Mail correspondence to:

M. R. A. C.

P.O. Box 070695

Milwaukee, WI 53207-0695

Board Meeting Minutes

By Mark AB9CD

Milwaukee Radio Amateurs' Club Board of Directors Meeting – 6/22/2009

Meeting called to order at Menomonee Falls Library by VP/acting President Brian White K9LCQ around 6:45PM.

Present were Brain K9LCQ, Al KC9IJJ, Mike KC9CMT and Dave WB9BWP. Absent was everyone else, old and new officers (June meeting would have outgoing and incoming officers attending). After determining that we did have a quorum (majority of people "in office at the time of a regular meeting") we proceeded with the meeting.

K9LCQ appointed Dave WB9BWP to take minutes of the meeting.

There was no Treasurers' report nor past meeting minutes due to people absent.

There was a brief discussion of the newly vacant positions of Treasurer and Secretary.

Will there be a program Thursday on the Softrock project? No one knew. Also a discussion on church key and if we will be able to meet indoors or out.

There was a discussion on Field Day. There have been recent daily emails to the club Yahoo group and there has been no response from anyone else with any Field Day ideas, plans, etc.

Sort of related to Field Day there was a discussion about the bike event in Ozaukee County which needs operators and ended up being scheduled for Field Day weekend (Sunday). The event does come through Pioneer Village so someone at Field Day could participate if needed.

The board was also reminded that the club needs someone to take over responsibility for the club web site (besides Treasurer and Secretary).

There was a short discussion on a Christmas Party. Joining with MAARS (513) will be brought up at their next meeting and Mike said he would ask at SMARC (South Milw) meeting so maybe we will be part of a 2 or 3 club party (if the other clubs agree).

There was a discussion on not having club meetings during the summer months (July, August?). No decision was made.

Al moved and Mike seconded that we adjourn as we really weren't doing anything.

Meeting adjourned at 7:12pm.

Amateur Radio Cross Banding

For this discussion, VHF = 144 MHz = 2m, UHF = 440MHz = 70cm. VHF receivers get desensitized by nearby VHF transmitters; same for UHF.

VHF receivers work very well in the presence of nearby UHF transmitters, and vice versa, even inside the same radio. Just make sure the UHF receive frequency is not equal to 3 times the VHF transmit frequency. Example: 147.00 x 3 = 441.00. Those frequencies would be ugly.

Amateur Radio operators are fortunate to have VHF and UHF allocations. That makes cross-banding possible. The FCC rules make it legal. In some countries, it's not legal.

Manual cross-banding might mean: you listening on a VHF simplex and talking on a UHF simplex; and a friend of yours doing the opposite. This allows you to interrupt each other.

Repeaters are now familiar devices. They use automatic control, legal here. Equipment manufacturers have made dual band equipment that does automatic (control) crossbanding. That makes cross-banding practical.

Automatic cross-banding might mean feeding the UHF receiver speaking signal into the VHF transmitter mic input. Or it might mean feeding the VHF receiver speaker signal into the UHF transmitter mic input. Either of these could be called one-way cross-banding.

Doing both of the above could be called 2 way cross-banding, 1 way at a time. Special considerations: beware of trying 2 way cross-banding with a repeater to extend your range. Your automatic cross-banding radio will not cease re-transmitting the repeater until its carrier drops, could be 5 seconds. It locks up in a 1 way cross-band state. There are several ways around that.

Listen to the repeater directly and do only a 1 way cross-band

Use two cross-banding radios, each doing 1 way cross-banding

Modify the operation of the repeater:

Have the other repeater users let the repeater carrier drop when they turn it over to you. This does not help you break in to a busy repeater with un-cooperative users

Have the repeater technical committee modify the repeater for no hang time = instant drop

Have the repeater technical committee modify the repeater to encode PL only when the squelch is open. Put PL decode on the cross-band radio section that re-transmits the repeater. This allows normal talking and break-in

Identification considerations: when you say your callsign thru you HT, you are also saying it thru your cross-band transmitter, thus identifying it. Other users should be told they are being cross-banded, so they can know what transmitter they might have to identify.

PL considerations: encode the repeater PL in your HT signal, and do not encode on the cross-band output signal

Temporary UHF cross-band frequencies coordinated per WAR: 446.425 446.4275 446.430 446.4325 446.435 446.4375 446.440 446.4425 446.445 446.4475 446.450 446.4525 446.455 446.4575 446.460 446.4625 446.465 446.4675 446.470 446.4725 446.475

FD Report

Another MRAC FD is in the books. We operated 3A this year with one CW station, one digital station and one phone station. For the first time since I've been a member of the club we operated the transmitters from generator power. This helped our score reach a number similar to previous years even though we had half as many transmitters on the air! Our score? 3434.

The highlights of FD this year for me were two CW operators worked the CW station. The surprise antenna seemed to work well for them. What was the surprise antenna? A hexagonal sloper dipole raised on a 40' mast. See the picture.

Another highlight was operating on generator power. Both generators essentially ran the entire 24 hours with one refueling (one may have gone all 24 hours on a single fill…. we need to ask Larry about this).

I wish to thank everyone who came out. A special thanks to Larry Noldan NZ9I for helping with planning prior to FD and making a run to AES for feed line on Friday before FD. A special thanks to Tony Kolar AB9PN for setup work on Friday afternoon and take-down on Sunday afternoon. Without their support, FD would have been much less interesting.

The best accomplishment from FD this year is the prep work put in place for FD 2010. An inventory of the equipment on site at PV was completed. Many items that collected at PV that had no business being there were removed. The radios and antennas used this year were stored in an orderly fashion and will be in working order when needed next year.

Some of the equipment found in disrepair were taken from PV and will be repaired before FD next year. This will put the FD captain for 2010 in a great place for another successful FD.

AB9CD

2009 FD captain

Field Day Encampment at Pioneer Village Restored Rail Station

Next Regular Meeting

The next meeting will be June 25th at 7:00PM. We meet in the Fellowship Hall of Redemption Lutheran Church, 4057 N Mayfair Road. Use the south entrance.

Please do not call the church for information!

Club Nets & Breakfast

Please check in to our nets on Friday evenings.

Our ten meter SSB net is at **8:30 p.m.** at **28.490 MHz USB.**

Our two meter FM net follows at 9:00 p.m. on our repeater at **145.390 MHz** with a minus offset and a **PL of 127.3 Hz.**

Join us for Saturday morning breakfast at **Maxim's Restaurant, 18025 W. Capitol Dr.** We usually meet at around 8:00 a.m., and order around 8:15 a.m. The food and the company are good and

You don't have to be a member of the club to join us!

Club Repeater, 145.390– MHz (127.3 PL)

Visit our website at: **www.w9rh.org**

Or phone (414) 332-MRAC or 332 - 6722

ARRL WISCONSIN SECTION MONTHLY NET ACTIVITY SUMMARY MAY 2009

NET	QNI	QTC	QTR	SSNS	NM
BWN	2248	2754	4189	31	W9IXG
BEN	564	54	1244	31	WD9FLJ
WSBN	610	63	1108	31	KB9KEG
WNN	160	12	334	31	KB9ROB
WSSN	187	17	308	30	N9JIY
WIN/E	196	32	255	31	WB9ICH
WIN/L	119	44	281	31	W9RTP
WRACES	86	3	240	5	N9VAO
totals	4170	2979	7959	221	

Note:

BWN is Badger Weather Net;

BEN is Badger Emergency Net;

WSBN is Wisconsin Side Band Net;

WNN is Wisconsin Novice Net;

WSSN is Wisconsin Slow Speed Net;

WIN/E is Wisconsin Intrastate Net/Early;

WIN/L is Wisconsin Intrastate Net/Late;

WRACES is Wisconsin Radio Amateur Civil Emergency Service net. Details on all these nets are found on this site: **https://www.arrl.org/sections/?sect=WI under Wisconsin Traffic Nets**.

Chatter Deadline

The **DEADLINE** for items to be published in the **Chatter** is the 7th of each month. If you have anything (announcements, stories, articles, photos, projects) for the 'Chatter, please get it to me before then.

You may contact me or Submit articles and materials by e-mail at: **Kc9cmt@earthlink.net**

or by Post at:

Michael B. Harris

807 Nicholson RD

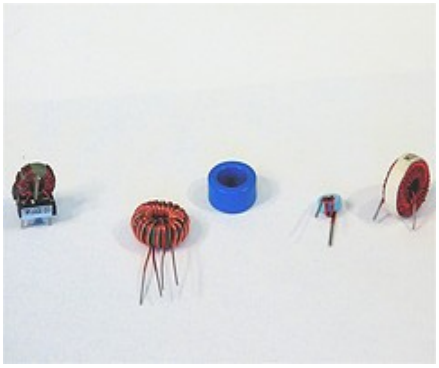
South Milwaukee, WI 53172-1447

Make a Joule Thief

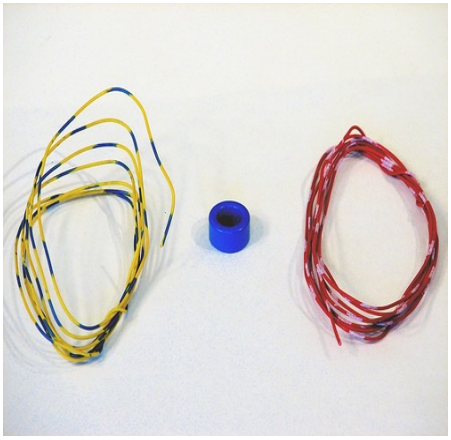
So what's a Joule Thief? It's a little wisp of a circuit that allows you to drive a blue or white LED from a low voltage. Normally, if you want to light up a blue or white LED you need to provide it with 3 - 3.5 V, like from a 3 V lithium coin cell. But a 1.5 V battery like a AA cell simply *will not work*. But using the Joule Thief, it works like a charm. Not only does it work with a brand new battery, but it works until the battery is nearly dead-- down to 0.3 V. That's well below the point where your other toys will tell you the battery is dead, so it can steal every last joule of energy from the battery (hence the name).

The original site (**http://www.emanator.demon.co.uk/bigclive/joule.htm**) where we learned about the Joule thief shows you how to make a miniature version of this circuit, such that you can fit it in a tiny flashlight. However, in the video we show you how to make it big, large enough (1) to make with clumsy hands and (2) that you can see what we're doing.

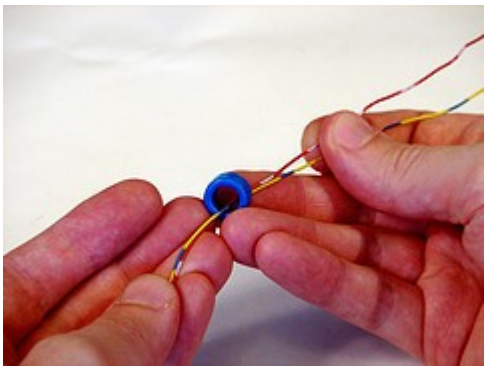
After the jump, some detailed photos of how the coil is wound in case you need more detail than in the video, and a technical discussion of how the Joule Thief works.



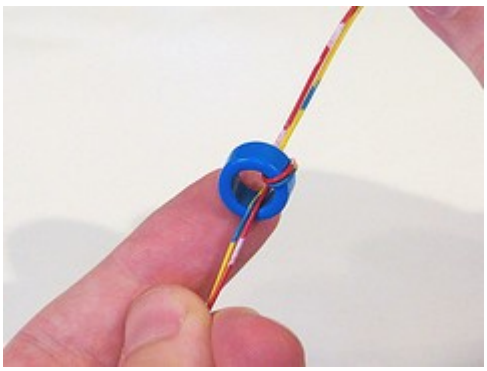
First, here is a selection of ferrite toroids, inductors, and transformers that are suitable for using to make a Joule Thief.



First, here is a selection of ferrite toroids, inductors, and transformers that are suitable for using to make a Joule Thief. Depending on the type that you start with, you may be able to use the existing wires or need to take them off and wind it yourself.

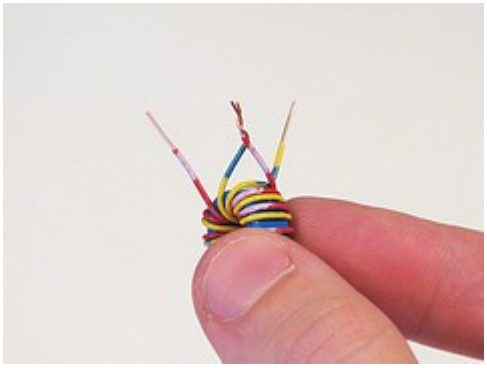


To wind your own coil, start with two colors of insulated wire and a bare ferrite toroid. Take the two strands of wire through the center of the toroid.

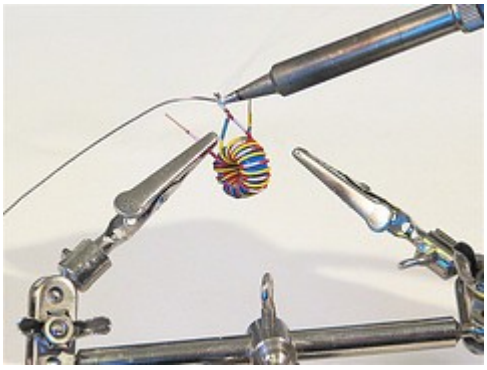


Keeping the two strands together, wrap them around and through the toroid again.

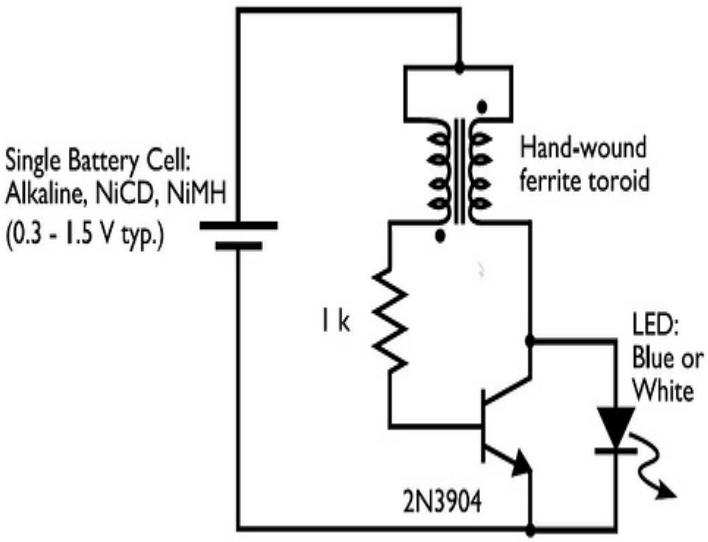
Keep winding until you fit as many turns as will fit in a single layer around the toroid, typically 7-10 turns with thin insulated wire.



Strip the wire ends. Take one wire from each pair *of different color* and attach them together.

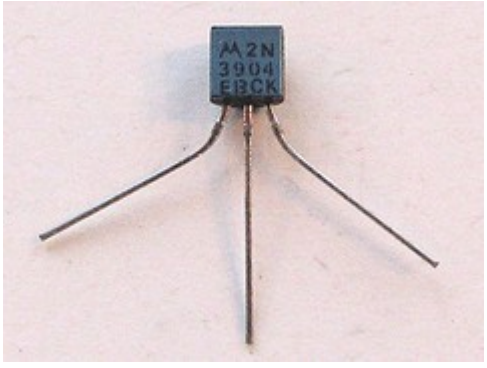


Solder the cross-over pair together. This is the "common" point of the coil windings.



In the circuit diagram for the Joule Thief, the common point of the toroid is the connection at the top of the hand-wound ferrite toroid, in the upper right of the diagram. This goes to the positive end of the battery. The other two wires from the toroid go to the resistor and to the intersection of the transistor with the LED.

One other detail that you may need to know is the symbol and pinout of the 2N3904 transistor. In the symbol, the part with the arrow is the "emitter", the "collector" is the end above it, that also connects to the LED, and the "base" is the wire leading off to the left, between the collector and emitter. (Also remember that the end of the LED with the flat side and short lead is the end that has the flat bar in the diagram.)



An actual 2N3904 transistor looks like this. The pins, holding it so that you can read the text on the flat side are (left to right) Emitter, Base, and Collector. I particularly like this one because it has that little EBC legend on the bottom.

So how does it work?

Imagine the condition when the battery is first connected. The transistor is off, but voltage can flow down the left side of the transformer (wound toroid) in the diagram, current limited by the resistor. This *turns on* the transistor, and a larger amount of current can flow through the other side of the transformer and through the resistor. Because the voltage applied across the LED is well below its forward voltage, no current flows through the LED, and the LED does not yet turn on.

The larger current flowing through the right side of the transformer induces a current in the left side of the transformer that opposes the existing current on the left side-- and the current on the left side quickly drops down to zero. When this happens, the transistor shuts off. With no current flowing in the left side of the transformer, the toroid acts like a simple inductor, which is like a flywheel for current. There is already current flowing though it, which cannot shut off immediately, and the resulting current (flow of electric charge) towards the collector of the shut-off transistor leads to a temporary increase in the voltage at that point, which continues until the voltage exceeds 3 V, at which point the current finds a way out-- through the LED, which lights up as current flows through it.

As the last of the current fades from the toroid, the LED shuts off again, and we again return to the initial state: no current flowing through either side of the toroid transformer. And the process begins again. This whole cycle happens at a typical rate of about 40 kHz, far too fast for you to see the blinking, and the light from the Joule Thief appears to be continuous. This is a simple example of a switching power supply driven by a transformer-coupled oscillator, made of only four components.

As a side note, this is not the most efficient circuit around; it's beauty is that it works with such a low voltage. So, this is a great circuit to use with a dead or dying battery, and less so for use with a brand new battery.

The joule

One joule is the amount of energy required to perform the following physical actions:

The work done by a force of one newton traveling through a distance of one metre;

The work required to move an electric charge of one coulomb through an electrical potential difference of one volt; or one coulomb volt, with the symbol C·V;

The work done to produce the power of one watt continuously for one second; or one watt second (compare kilowatt hour), with the symbol W·s.

Fox Cities Amateur Radio Club to operate at the EAA AirVenture 2009

** The Fox Cities Amateur Radio Club, W9ZL will once again operate a Special Event station from the grounds of the EAA AirVenture 2009. We will operate 5 days -- Wednesday through Sunday, during the last week of July. This operating event is open to all license classes. We will operate 2 HF stations, one on 20m and one on 40m, plus local communications on 2-meters. The club call, W9ZL, will be used throughout the event. We are looking for both "am" and "pm" operators covering each of the 5 days. You can sign up for one shift or more if you so desire. The event is open to all of the amateur community. If operators sign up for a 4 hour shift, they will be given a daily wristband that will allow them to go and wonder around the Fly-in. For further information go to: ***http://fcarc.us/eaa/eaa.htm*** or contact Jon Oldenburg AB9AH @ AB9AH@arrl.net, or (920)832-9727

Thanks! Jon Oldenburg AB9AH Special Event Coordinator EAA AirVenture 2009

From the ARRL Weekly Bulletin

** QST has published the results of SET2008 in its July issue. Wisconsin ARES/RACES team members, ECs, DECs, and the leadership team can be very proud of Wisconsin's league leading point total! However, while ARRL assigns points for the various aspects of the SET and posts the point totals of the 'winners' in QST, the SET isn't a contest and it's not about the points. The takeaways of the Simulated Emergency Test are about ARES/RACES teams working together under simulated emergency conditions to fulfill our core mission of providing reliable and efficient short and long haul communications to our served agencies. The SET helps us highlight our strong points and make them stronger and, just as importantly, identify the areas where we can do better so we can upgrade our planning and training and do even better in the next SET or, if the need arises, in the real thing. Everyone who participated, organized, planned, and coordinated SET2008 can take a great deal of pride in the outcome. The challenge now is to continue to excel, continue to train, plan, and exercise. The rewards are not only for us, they're for our served agencies and Wisconsin's citizens, visitors, and guests.

Best regards, Skip Sharpe, W9REL, ASEC for Administration.

FRESH AIR, FRIENDS, FOOD AND FUN ABOUND FOR 2009 ARRL FIELD DAY

It's an event that some groups take very seriously, planning all year long for. Still, others just use the date to get together, make a few contacts and enjoy each other's company. No matter how you view it, ARRL Field Day **<http://www.arrl.org/fieldday>** is fun!

According to ARRL Field Day Manager Dan Henderson, N1ND, the Field Day Site Locator **<http://www.arrl.org/contests/announcements/fd/locator.php>** was a big hit this year. "We had 1602 groups listed -- 98 more sites than were listed in 2008," he said. "We had all 50 states, Puerto Rico and nine Canadian provinces registered on the Locator this year."

Henderson said he was aware of at least one Field Day contact with the International Space Station **<http://www.arrl.org/news/stories/2009/06/25/10910/?nc=1>,** as well as several site visits by Members of Congress and local officials to various Field Day sites around the country.

ARRL Media and Public Relations Manager Allen Pitts, W1AGP, agreed that it was a great Field Day. "Despite some propagation issues in the atmosphere," he said, "the PR propagation in the media has been more than I have seen before in prior Field Days." Pitts said that the emphasis on Field Day promotions began long before June -- the ARRL released media kits, fill-in-the-blank proclamations, news releases and tip sheets. Along with the introduction of the PR-101 course <**http://www.arrl.org/news/stories/2009/05/15/10817/?nc=1>**, Field Day was also the presentation theme at the 2009 ARRL National Convention at the Dayton Hamvention.

"The preparation appears to have paid off well," Pitts said. "Hundreds of hits have been relayed in by Google's news monitoring, plus more from PR Newswire and spotting by ARRL Public Information Officers around the country. Both of the video Field Day PSAs **<http://www.arrl.org/news/stories/2009/03/28/10728/?nc=1**> have seen good play on TV and cable. Field Day even got some play in New York City's Times Square" **<http://www.arrl.org/news/stories/2009/06/23/10904/?nc=1>.**

Pitts said that many city and county officials -- as well as 28 states -- issued Field Day proclamations praising Amateur Radio: "Proclamations from the governors of Alabama, Arizona, Arkansas, Colorado, Connecticut, Florida, Illinois, Indiana, Iowa, Kansas, Louisiana, Michigan, Minnesota, Mississippi, Missouri, Nebraska, New Hampshire, New Mexico, North Carolina, North Dakota, Ohio, Oklahoma, Pennsylvania, Tennessee, Texas, Washington and Wyoming, as well as Delaware's State Senate, are not just recognitions of the past, but keys for future political actions such as PRB-1 and legislative issues." These state proclamations range from Ohio declaring June 27 as Amateur Radio Day, to Florida, Delaware, Illinois, New Hampshire and Pennsylvania pronouncing June as Amateur Radio Month in those states, while other states have designated Amateur Radio Week in their states.

It's not too early to begin preparing for **next year's Field Day** -- go ahead and mark your calendars now for **June 26-27, 2010**.

Testing & Local SwapFests

VE Testing

Saturday, July 25th

AES - 9:30AM

Amateur Electronic Supply 5720 W. Good Hope Rd. Milwaukee, WI 53223

Local Swapfests

Saturday, August 15th

Racine Megacycle Free fest 2009 Racine Megacycle Club Fireman's Park

http://www.w9udu.org

Talk-In: 147.270MHz + offset (PL None)

Saturday, September 12th

ORC Fall Ham & Hobby Swapfest

Ozaukee Radio Club

Fireman's Park

http://www.ozaukeeradioclub.org

Talk-In: 146.970MHz - offset (PL 127.3)

Working Committees

Field Day

- Mark - AB9CD

FM Simplex Contest

- Sherm – KB9Q
- Joe – N9UX
- Jeff – K9VS
- Brian— K9LCQ

Ticket drum and drawing

- Tom – N9UFJ
- Jackie – No Call

Newsletter Editor

- Michael-KC9CMT

Webmaster

- Open

Refreshments

- Michael – KC9CMT

Membership Information

The Hamateur Chatter is the newsletter of MRAC (Milwaukee Radio Amateurs' Club), a not for profit organization for the advancement of amateur radio and the maintenance of fraternalism and a high standard of conduct. MRAC Membership dues are $17.00 per year and run on a calendar year starting January 1st. MRAC general membership meetings are normally held at 7:00PM the last Thursday of the month except for November when Thanksgiving falls on the last Thursday when the meeting moves forward 1 week to the 3rd Thursday and December, when the Christmas dinner takes the place of a regular meeting. Club Contact Information Our website address http://www.w9rh.org

Telephone (414) 332-MRAC (6722)

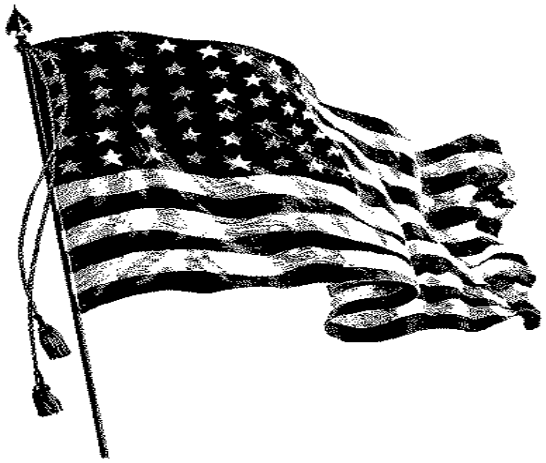
Address correspondence to: **MRAC PO Box 070695, Milwaukee WI 53207-0695**.

Email may be sent to

w9rh@arrl.net

Our YAHOO newsgroup:

http://groups.yahoo.com/group/MRAC-W9RH/



CLUB NETS:

- Our Six Meter SSB net is Thursday at 8:00PM on 50.160 MHz USB
- Our Ten Meter SSB net is Friday at 8:00PM on 28.490 MHz ± 5 KHz USB.
- Our Two Meter FM net follows at 9:00PM on our repeater at 145.390MHz - offset (PL 127.3)

Milwaukee Area Nets

Mon.8:00 PM 3.994 Tech Net

Mon.8:00 PM 146.865- ARES Walworth ARRL News Line

Mon.8:00 PM 146.445 Emergency Net

Mon.8:00 PM 146.865- ARES Net Walworth

Mon.8:45 PM 147.165- ARRL voice news (ARES)

Mon.9:00 PM 50.160 6 mtr .SSB NET

Mon.9:00 PM 147.165- ARES Net Waukesha-Milwaukee

Tue.9:00 AM 50.160 6 . Mtr 2nd Shifter's Net

Tue. 9:00 PM 145.130 Handshakers National Net

Tue. 8:00 PM 7.035 A.F.A.R. (CW)

Wed. 8:00 PM 145.130 MAARS Amateur Radio Newsline

Wed. 9:00 PM 145.130 MAARS IRLP SwapNet

Thur. 9:00 PM 50.160, 6 mtr SSB Net

Thur. 9:00 PM 146.910 Computer Net

Fri. 8:30 PM 28.490 MRAC W9RH 10 mtr Net SSB

Fri. 9:00 PM 145.390 W9RH 2 mtr. FM Net

Sat. 9:00 PM 146.910 Saturday Night Fun Net

Sun 8:30 AM 3.985 QCWA (Chapter. 55) SSB Net

Sun 9:00 AM 145.565 X-Country Simplex Group

Sun.10:00 AM 443.800+ FM-38 link to 146.88 Baraboo SWAP Net

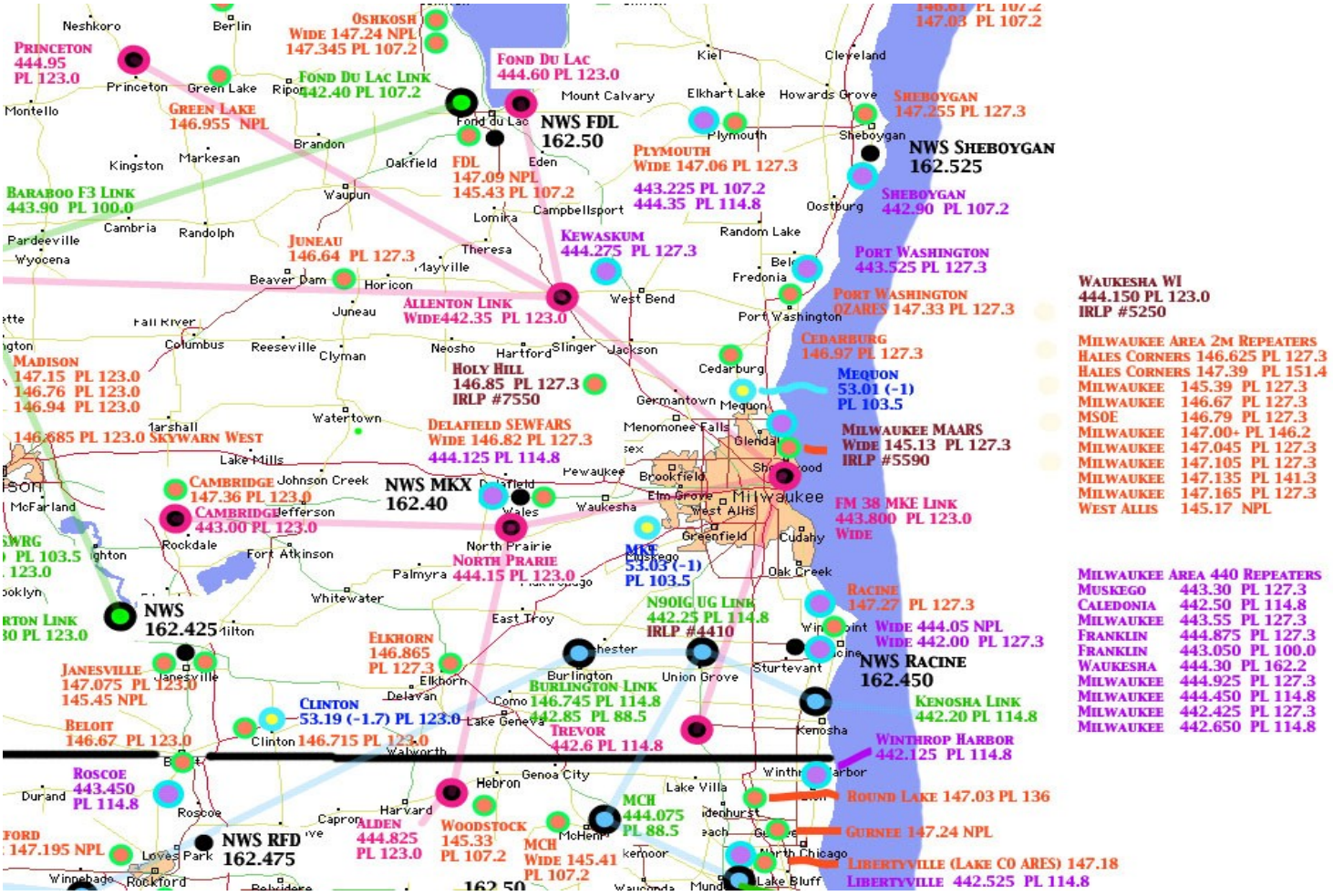
Sun 9:00 PM 146.910 Swap Net

Sun 8:00 PM 146.910 Information Net

Sun.8:00 PM 28.365 10/10 International (Milwaukee Ch.) (SSB)

2 meter repeaters are offset by 600KHz - - 70 centimeter repeaters are offset by 5 MHz

SSB frequencies below 20 meters are LSB and for 20 mtrs and above are US


Princeton 444.95 PL 123.0
Green Lake
Fond Du Lac Link 442.40 PL 107.2
Green Lake 146.955 NPL
Oshkosh Wide 147.24 NPL 147.345 PL 107.2
Fond Du Lac 444.60 PL 123.0
NWS FDL 162.50
FDL 147.09 NPL 145.43 PL 107.2
Baraboo F3 Link 443.90 PL 100.0
Juneau 146.64 PL 127.3
Kewaskum 444.275 PL 127.3
Allenton Link Wide442.35 PL 123.0
Madison 147.15 PL 123.0 146.76 PL 123.0 146.94 PL 123.0
Holy Hill 146.85 PL 127.3 IRLP #7550
Delafield SEWFARS Wide 146.82 PL 127.3 444.125 PL 114.8
Skywarn West
Cambridge 147.36 PL 123.0
Cambridge 443.00 PL 123.0
NWS MKX 162.40
North Prairie North Prairie 444.15 PL 123.0
NWS 162.425
Janesville 147.075 PL 123.0 145.45 NPL
Elkhorn 146.865 PL 127.3
Clinton 53.19 (-1.7) PL 123.0
Beloit 146.67 PL 123.0
Clinton 146.715 PL 123.0
Burlington Link 146.745 PL 114.8 442.85 PL 88.5
Trevor 442.6 PL 114.8
Roscoe 443.450 PL 114.8
NWS RFD 162.475
Alden 444.825 PL 123.0
Woodstock 145.33 PL 107.2
MCH Wide 145.41 PL 107.2
MCH 444.075 PL 88.5
Plymouth Wide 147.06 PL 127.3 443.225 PL 107.2 444.35 PL 114.8
Sheboygan 147.255 PL 127.3
NWS Sheboygan 162.525
Sheboygan 442.90 PL 107.2
Port Washington 443.525 PL 127.3
Port Washington OZARES 147.33 PL 127.3
Cedarburg 146.97 PL 127.3
Mequon 53.01 (-1) PL 103.5
Milwaukee MAARS Wide 145.13 PL 127.3 IRLP #5590
FM 38 MKE Link 443.800 PL 123.0 Wide
MKE Muskego 53.03 (-1) PL 103.5
N90IG UG Link 442.25 PL 114.8 IRLP #4410
Racine 147.27 PL 127.3
Wide 444.05 NPL
Wide 442.00 PL 127.3
NWS Racine 162.450
Kenosha Link 442.20 PL 114.8
Winthrop Harbor 442.125 PL 114.8
Round Lake 147.03 PL 136
Gurnee 147.24 NPL
Libertyville (Lake CO ARES) 147.18
Libertyville 442.525 PL 114.8
147.03 PL 107.2
Waukesha WI 444.150 PL 123.0 IRLP #5250
Milwaukee Area 2M Repeaters
Hales Corners 146.625 PL 127.3
Hales Corners 147.39 PL 151.4
Milwaukee 145.39 PL 127.3
Milwaukee 146.67 PL 127.3
MSOE 146.79 PL 127.3
Milwaukee 147.00+ PL 146.2
Milwaukee 147.045 PL 127.3
Milwaukee 147.105 PL 127.3
Milwaukee 147.135 PL 141.3
Milwaukee 147.165 PL 127.3
West Allis 145.17 NPL
Milwaukee Area 440 Repeaters
Muskego 443.30 PL 127.3
Caledonia 442.50 PL 114.8
Milwaukee 443.55 PL 127.3
Franklin 444.875 PL 127.3
Franklin 443.050 PL 100.0
Waukesha 444.30 PL 162.2
Milwaukee 444.925 PL 127.3
Milwaukee 444.450 PL 114.8
Milwaukee 442.425 PL 127.3
Milwaukee 442.650 PL 114.8